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Improving dielectric permittivity by incorporating PDMS-PEG block copolymer into PDMS network

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Polydimethylsiloxane (PDMS) is well-known to cause hydrophobic surfaces due to their low surface energy as well as they possess low conductivity and extremely low glass transition temperature[1]. On the other hand, polyethyleneglycol (PEG) behaves hydrophilic and is a highly conductive polymer. Combination of both polymers as a block copolymer depicts a possibility for substantial improvement of properties such as high permittivity and non-conductivity – if carefully designed[2]. The objective of my research is to synthesize PDMS-PEG block copolymer assembling into different morphologies such as lamellae, cylinder, gyroid and spheres based on different volume fraction ratio of PDMS and PEG. The synthesis of PDMS-PEG block copolymer is based on hydrosilylation reaction occurring at 60 °C and dry condition with presence of platinum catalyst as shown in Fig. 1[3,4]. Different volume fraction of PDMS and PEG introduces different properties in terms of contact angles, dielectric permittivity and rheological behaviour. All morphologies of PDMS-PEG block copolymer in this study exhibit high storage permittivity; at the same time the loss permittivity is even higher which implies that the synthesized PDMS-PEG block copolymers are conductive. By incorporating conductive PDMS-PEG block copolymer into commercial PDMS elastomer from Wacker Chemie, the storage permittivity is significantly enhanced by 38% with 20% of PDMS-PEG block copolymer incorporated in pure PDMS network as depicted in Fig. 2.

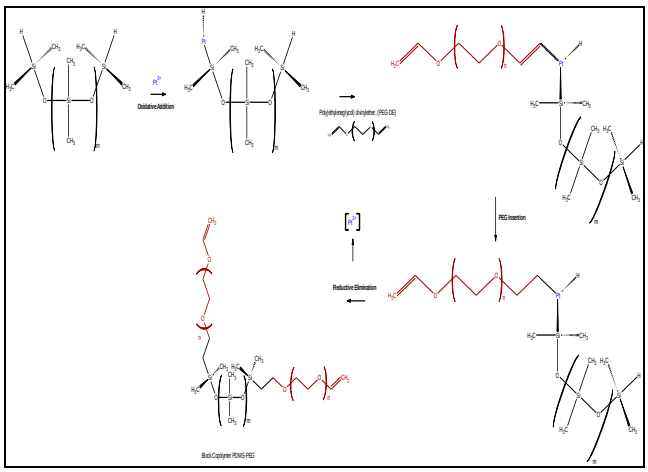

Fig. 1: Hydrosilylation of PDMS-PEG block copolymer.

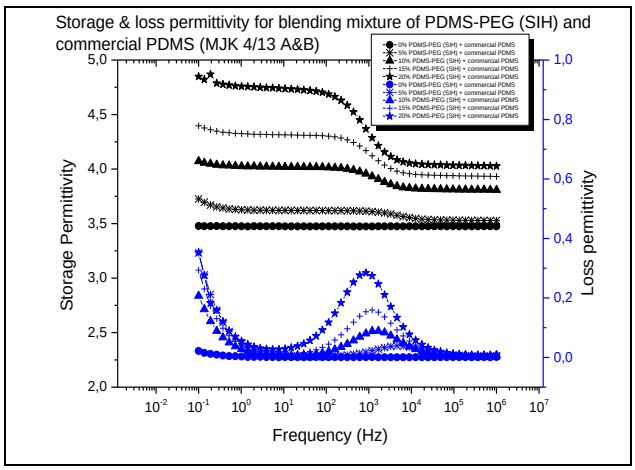

Fig. 2: Dielectric permittivity results.

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